

The Composition of Value Added in the 1963 Input-Output Study

THIS article presents estimates of the composition of value added by industry in 1963, supplementing the data on total value added by industry that were published in the initial article on the input-output study for 1963.¹ Also presented are some illustrations of how these new and more detailed data can be used to estimate the impact that changes in the level or composition of GNP may have on the aggregate levels and industrial composition of the value-added components.

As defined by BEA, an industry's value added is the measure of its contribution to GNP, i.e., to the Nation's output of goods and services.² It can be measured as the difference between the value of the industry's total output and the cost of the goods and services it purchases from other industries; or, it can be calculated by summing the industry's payments to the factors of production (employee compensation, profits, etc.) and its nonfactor costs (depreciation, property and sales taxes, etc.). This article shows value added divided into 3 components—employee compensation, indirect busi-

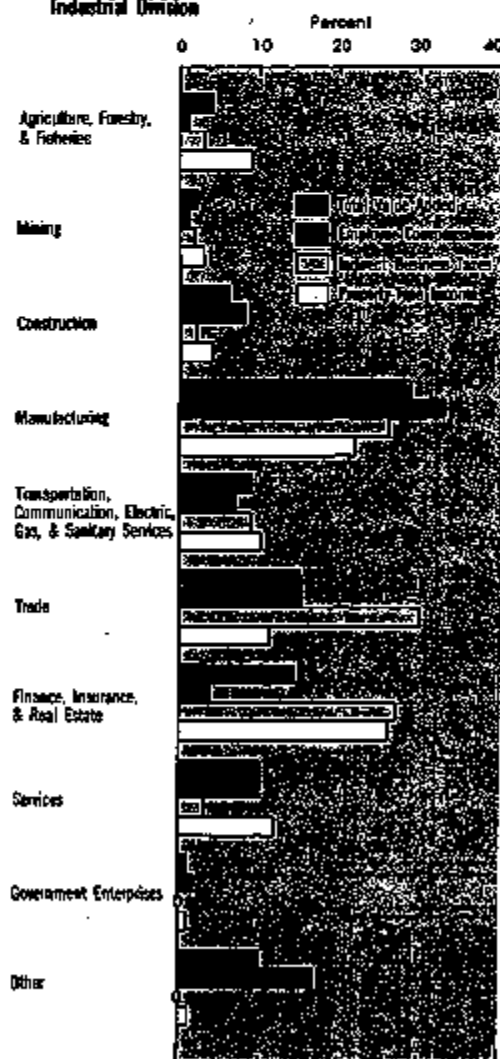
ness taxes, and property-type income (gross of depreciation)—for each of the 78 producing and 4 special industries of the 1963 input-output table.

These estimates were developed from data compiled for the more aggregative series on gross product originating (GPO) by industry published annually by BEA. The value-added components have been reallocated to match the industrial classification and the concepts and conventions relating to definitions of output used in the 1963 I-O study.³ A reconciliation of these newly developed estimates of industry value added for the year 1963 with the GPO estimates for 1963 is provided in an appendix to this article so that GPO data and national income by industry data available for other years can be adapted for use in input-output analysis.

The additional detail on components of value added permit an interesting application of input-output analysis. The detail is used, in conjunction with data on imports from the original 1963 I-O study, to calculate the amount of primary inputs (value added and imports) that would be generated directly and indirectly by the sale of one unit (one dollar or one million dollars' worth) of each industry's output to final demand. Although the principal focus of this article is on the additional detail on the components of value added, the use of these data within the I-O framework to show the relationship between an industry's sale to final demand and its direct and indirect demand for primary inputs requires the inclusion of imports for completeness. The estimates presented

in this article of the amounts of the primary inputs generated by an industry's sales to final demand show

CHART 10
Industrial Composition of Value Added, 1963
Percentage of Total Value Added, and of its Components, Originating in Each Major Industrial Division



NOTE.—The statistical work to allocate the aggregate amounts of the value added components to I-O industries, and to reconcile the I-O detail with the estimates of gross product originating by industry was directed by William M. Eisenberg, formerly with BEA and now with the Bureau of Labor Statistics.

1. "Input-Output Structure of the U.S. Economy, 1963," *Survey*, November 1969. A single value added figure is shown there for each of the producing industries (2-O 1-79) and four special industries (2-O 84-87).

2. This is somewhat different from the definition used by the Bureau of the Census to calculate "value added by manufacture" as published in the *Census of Manufactures* and the *Annual Survey of Manufactures*. Census defines value added as the difference between the value of production (value of shipments plus miscellaneous receipts adjusted for changes in inventories of goods in process and finished goods) and the cost of materials, supplies, containers, fuels, purchases of electricity, and contract work put into production. The most important conceptual differences are that BEA's measure adds the sales and excise taxes collected in the industry but subtracts the cost of services supplied by other industries.

3. Additional comments on the methodology used to allocate the components of value added among the industries in mining and manufacturing are found in the technical note at the end of this article.

that its composition varies widely among industries and therefore, different patterns of final demand will have associated with them different proportions of the value-added components.

Three uses for the new value-added detail are illustrated in this article.⁴ (1) It is used to measure the amounts of the value-added components and of imports generated by each major GNP component in 1963. (2) It is

used to measure the impacts that \$1 billion of final demand spent in alternative ways can have on the aggregate amount of employee compensation. This type of analysis can be carried out for other components of value added as well. (3) It is used (with certain rather restrictive assumptions) to trace the impact that changes in cost in any one industry can have on the prices of other industries' products.

Composition of Value Added

Industrial origin of value added and its components

Table 1 shows total value added in each I-O industry, disaggregated into three components: employee compensation, indirect business taxes, and property-type income. The industry detail in table 1 is that used in the 85-order I-O tables published in the November 1969 article. Total output (column 1) and value added (column 2) are the same as published in table 1 of that article. The I-O value-added components relate to the detail published in the national income and product (NIP) accounts as follows:

I-O Value-Added Components	NIP Accounts
Employee compensation	Employee compensation
Indirect business taxes	Indirect business tax and excise tax liability
Property-type income	Proprietors' income Rental income of persons Corporate profits and inventory valuation adjustment Net interest Business transfer payments Surplus of government enterprises less subsidies Capital consumption allowances

It was not feasible to allocate property-type income for 1963 in greater detail among the I-O industries. Some components shown in the NIP

accounts, however, affect just a few I-O industries. Rental income of persons occurs only in the real estate and rental industry (I-O 71), the surplus of government enterprises, in Federal and State and local enterprises (I-O 78, 79), and the inventory valuation adjustment is shown separately in I-O 87.

Chart 10 shows the percentages of total value added, and of each of its components, originating in each major industry division in 1963. It is based on the data in columns 2-5 of table 1. Manufacturing was the main source of value added, contributing 29 percent of the total; it was followed by trade with 15 percent, and by finance-insurance-real estate with 14 percent.

Manufacturing was an even more important source of employee compensation than of value added as a whole, accounting for 33 percent. The next most important source, with 17 percent, was the "other" industries (general government, households, and the rest of the world).

Trade accounted for the largest share, 30 percent, of indirect business taxes, mainly reflecting sales taxes collected in trade channels. Finance-insurance-real estate and manufacturing followed closely with 27 percent and 26 percent, respectively. Property taxes on rental property and on owner-occupied housing are the main element in indirect business taxes originating in finance-insurance-real estate, and excise taxes are the main element in manufacturing.

Finance-insurance-real estate was the main source of property-type income, accounting for 27 percent of the total.

Imputations in the national accounts for the value of banking services provided without explicit charges and for the rental value of owner-occupied housing have a strong influence on estimates of profits and of rental income of persons and, therefore, on the property income component of value added in this industry division. Manufacturing's share of property-type income was 22 percent—smaller than its share of value added as a whole. Agriculture accounted for 9 percent of property-type income, double its share of value added as a whole, reflecting the importance of net earnings of farm proprietors in this sector of the economy.

Value added components

For all industries combined, employee compensation accounted for 59 percent of value added in 1963, property-type income for 33 percent, and indirect business taxes for 9 percent. Columns 6-9 of table 1 show the composition of each industry's value added. The composition is plotted in chart 11, where the industries are ranked according to the share of employee compensation in value added. The employee compensation share of value added in Federal Government enterprises (I-O 78) is slightly over 100 percent because deficits, mainly in the post office, more than offset earnings of other Federal enterprises. From this point the compensation share ranges down to slightly over 2 percent in the real estate and rental industry (I-O 71) whose low share is due mainly to definitions and conventions used in the I-O study; compensation for maintenance construction done on force account is redefined out of the industry in the I-O accounts (see technical note) and imputations for the rental value of owner-occupied housing, already mentioned, are included.

Employee compensation was less than half of value added in only 15 of the I-O industries. Two types of industry are in this group. The first consists of industries where self-employment is important, which boosts property-type income relative to employee compensation. This type includes farms (I-O 1 and 2), forestry and fisheries (I-O 3), and services,

4. It is important to point out certain dangers in analyses that depend on the assumption of stability (over time and through a range of output levels) of the composition of each industry's value added. For example, corporate profits may vary widely from year to year and indirect business taxes are affected by state and local legislation establishing new and revised sales and property taxes. Therefore, the data presented here are most useful for years close to 1963; for other years, the data should be adjusted to reflect known changes. Detailed value-added data for 1967 are being prepared in connection with the 1967 I-O study, which is due to be released later this year.

Table 1.—Components of Value Added for Industries in the Input-Output Table, 1963

Industry No.	Industry 1	Total output	Value added	Em- ployee com- pen- sa- tion	Indirect busi- ness taxes	Propri- etary type income	Total	Em- ployee com- pen- sa- tion	Indirect busi- ness taxes	Propri- etary type income	Value added	Em- ployee com- pen- sa- tion	Indirect busi- ness taxes	Propri- etary type income
		1	2	3	4	5	6	7	8	9	10	11	12	13
		Millions of dollars						Ratios to value added				Ratios to total output		
	Total	599,391	341,514	54,527	154,245	1,000	0.570	0.163	0.329					
1	Agriculture, Forestry & Fisheries	57,473	22,782	3,372	1,531	17,819	1.000	.448	.067	.785	0.406	0.039	0.023	0.319
2	Livestock & livestock products	20,964	8,992	1,181	681	4,930	1.000	.476	.087	.727	0.251	0.044	0.022	0.188
3	Other agricultural products	27,266	14,838	1,034	870	12,330	1.000	.408	.069	.833	0.444	0.046	0.033	0.433
4	Forestry & fishery products	1,761	998	131	7	485	1.000	.566	.012	.793	0.341	0.077	0.004	0.398
5	Agricultural, forestry & fishery services	1,772	382	452	47	43	1.000	.777	.081	.148	0.228	0.265	0.036	0.467
6	Mining	30,870	11,049	3,734	962	6,343	1.000	.338	.087	.435	0.337	0.181	0.047	0.309
7	Iron & ferroalloy ores mining	1,459	475	200	66	212	1.000	.421	.138	.446	0.332	0.140	0.044	0.148
8	Nonferrous metal ores mining	1,015	625	366	54	205	1.000	.586	.086	.528	0.411	0.241	0.038	0.336
9	Coal mining	2,637	1,540	821	47	572	1.000	.568	.061	.371	0.394	0.249	0.018	0.217
10	Crude petroleum & natural gas	12,256	0,000	1,010	732	4,684	1.000	.218	.106	.675	0.000	0.129	0.090	0.322
11	Stone & clay mining & quarrying	3,026	1,123	583	53	489	1.000	.519	.045	.435	0.333	0.208	0.026	0.242
12	Chemical & fertilizer mineral mining	699	380	154	16	292	1.000	.428	.042	.531	0.517	0.231	0.022	0.274
13	Construction	55,333	37,422	30,645	816	7,458	1.000	.774	.024	.201	0.434	0.236	0.011	0.487
14	New construction	49,819	25,890	10,859	779	5,262	1.000	.707	.028	.203	0.385	0.242	0.012	0.480
15	Maintenance & repair construction	19,794	11,142	8,786	137	2,206	1.000	.790	.012	.296	0.562	0.444	0.007	0.111
16	Manufacturing	466,415	178,972	113,731	14,431	45,226	1.000	.685	.082	.233	0.367	0.244	0.039	0.469
17	Ordinance & accessories	1,892	2,626	2,226	30	249	1.000	.882	.020	.091	0.901	0.383	0.008	0.490
18	Food & kindred products	74,263	13,888	11,080	8,441	6,383	1.000	.565	.178	.271	0.289	0.149	0.048	0.272
19	Tobacco manufactures	7,435	3,610	464	2,183	1,032	1.000	.481	.282	.238	0.486	0.287	0.138	0.388
20	Bread & narrow fabrics, yarn & thread mills	10,131	3,472	2,527	77	778	1.000	.760	.016	.224	0.254	0.201	0.004	0.269
21	Miscellaneous textile goods & floor coverings	3,008	1,586	582	15	79	1.000	.887	.022	.120	0.179	0.133	0.004	0.222
22	Apparel	15,030	6,772	3,400	83	1,289	1.000	.797	.012	.190	0.376	0.300	0.005	0.372
23	Miscellaneous fabricated textile products	3,174	752	602	20	69	1.000	.882	.027	.099	0.287	0.298	0.005	0.372
24	Lumber & wood products, except containers	10,684	3,862	2,544	99	1,208	1.000	.660	.036	.314	0.382	0.239	0.003	0.114
25	Wooden containers	420	144	130	9	11	1.000	.993	.031	.075	0.443	0.370	0.007	0.338
26	Household furniture	4,067	1,613	1,218	29	265	1.000	.618	.018	.164	0.397	0.324	0.007	0.355
27	Other furniture & fixtures	1,024	312	670	15	130	1.000	.922	.030	.048	0.422	0.348	0.006	0.323
28	Paper & allied products, except containers	13,119	4,812	3,970	115	1,728	1.000	.817	.024	.249	0.367	0.226	0.009	0.310
29	Paperboard containers & boxes	4,748	1,888	1,803	36	549	1.000	.880	.019	.281	0.398	0.274	0.006	0.447
30	Printing & publishing	10,263	7,598	6,365	240	1,896	1.000	.808	.019	.177	0.454	0.390	0.006	0.468
31	Chemicals & selected chemical products	10,843	6,587	3,251	229	3,507	1.000	.472	.019	.078	0.408	0.127	0.006	0.286
32	Plastics & synthetic materials	6,841	2,535	1,889	39	1,117	1.000	.648	.045	.331	0.403	0.221	0.006	0.178
33	Drugs, cleaning & toilet preparations	0,043	8,719	1,981	22	1,975	1.000	.466	.014	.381	0.411	0.187	0.004	0.218
34	Paints & allied products	2,453	891	1,510	69	302	1.000	.572	.021	.368	0.362	0.207	0.008	0.147
35	Petroleum refining & related industries	20,357	6,100	1,928	2,981	496	1.000	.377	.103	.287	0.284	0.088	0.123	0.323
36	Rubber & miscellaneous plastics products	9,391	4,418	2,760	477	1,145	1.000	.682	.028	.280	0.445	0.282	0.048	0.116
37	Leather tanning & industrial leather products	6,687	2,511	1,201	17	263	1.000	.891	.020	.179	0.299	0.286	0.006	0.447
38	Footwear & other leather products	3,437	1,608	1,255	17	263	1.000	.821	.011	.108	0.439	0.305	0.005	0.474
39	Glass & glass products	2,882	1,807	1,070	21	816	1.000	.686	.018	.321	0.448	0.306	0.007	0.176
40	Stone & clay products	0,516	4,904	2,807	102	1,496	1.000	.681	.022	.547	0.491	0.303	0.011	0.167
41	Primary iron & steel manufacturing	24,818	10,453	6,333	284	3,188	1.000	.654	.022	.334	0.425	0.276	0.009	0.123
42	Primary nonferrous metals manufacturing	14,272	2,890	2,452	132	1,425	1.000	.616	.026	.368	0.279	0.173	0.007	0.180
43	Metal containers	2,443	3,838	2,808	23	204	1.000	.728	.008	.214	0.341	0.240	0.009	0.088
44	Heating, plumbing & structural metal products	8,096	3,371	2,597	74	700	1.000	.770	.029	.248	0.374	0.289	0.008	0.078
45	Stampings, screw machine products & bolts	4,855	2,237	1,581	38	843	1.000	.663	.017	.280	0.431	0.313	0.008	0.131
46	Other fabricated metal products	0,043	3,748	2,635	78	1,035	1.000	.704	.018	.276	0.418	0.294	0.006	0.115
47	Engines & turbines	2,306	881	700	10	212	1.000	.752	.020	.328	0.388	0.292	0.006	0.088
48	Farm machinery & equipment	3,040	1,013	901	31	81	1.000	.680	.031	.328	0.326	0.265	0.010	0.028
49	Construction, mining & oil field machinery	4,082	1,887	1,177	35	395	1.000	.782	.023	.248	0.394	0.290	0.009	0.097
50	Materials handling machinery & equipment	1,817	585	437	12	145	1.000	.734	.020	.245	0.368	0.226	0.007	0.060
51	Metalworking machinery & equipment	5,144	2,512	2,084	54	364	1.000	.834	.021	.145	0.488	0.307	0.010	0.071
52	Special industry machinery & equipment	3,716	1,541	1,312	25	194	1.000	.811	.028	.125	0.418	0.383	0.009	0.052
53	General industrial machinery & equipment	2,384	2,410	1,808	45	559	1.000	.749	.019	.282	0.400	0.387	0.009	0.104
54	Machine shop products	2,217	1,157	994	40	291	1.000	.797	.029	.177	0.503	0.401	0.013	0.089
55	Office, computing & accounting machines	8,025	2,020	1,334	85	601	1.000	.820	.042	.288	0.315	0.340	0.022	0.133
56	Service industry machines	3,881	1,088	791	47	294	1.000	.727	.043	.280	0.321	0.283	0.014	0.074
57	Electric industrial equipment & apparatus	6,435	3,008	2,252	58	606	1.000	.782	.016	.204	0.468	0.302	0.007	0.028
58	Household appliances	4,872	1,616	1,022	168	323	1.000	.675	.111	.214	0.394	0.219	0.036	0.127
59	Electric lighting & wiring equipment	3,031	1,279	838	61	394	1.000	.647	.048	.315	0.415	0.290	0.020	0.127
60	Radio, television & communication equipment	12,448	6,042	4,948	268	727	1.000	.832	.045	.122	0.478	0.358	0.021	0.028
61	Electronic components & accessories	4,512	2,121	1,778	49	304	1.000	.834	.032	.142	0.473	0.394	0.011	0.067
62	Misc. electrical machinery, equipment, & supplies	2,256	957	684	22	289	1.000	.860	.028	.260	0.482	0.381	0.023	0.128
63	Motor vehicles & equipment	40,031	11,892	6,642	2,320	2,920	1.000	.588	.196	.298	0.367	0.186	0.059	0.073
64	Aircraft & parts	14,317	6,004	6,193	117	379	1.000	.625	.018	.097	0.481	0.437	0.0	

such as auto repair (I-O 75). The second type consists of industries with heavy investments in property or natural resources. They are the highly automated and mechanized industries such as those producing chemicals (I-O 27), drugs and cleaning and toilet preparations (I-O 28), and tobacco products (I-O 15); or utilities with heavy investment in plant and equipment, e.g., electric, gas, water, and sanitary services (I-O 68) and communications (I-O 66); or extractive industries, e.g., iron mining (I-O 5) and petroleum and natural gas (I-O 8).

The indirect business tax share of value added is between 2 and 5 percent in most industries. It is a bit higher in industries where investment in property

is significant, such as agriculture, mining, and real estate rentals, reflecting the property tax. The share of indirect business taxes in value added is also relatively high in industries that make significant payments of excise and special sales taxes, such as tobacco products (I-O 15), petroleum products (I-O 31), communications (I-O 66), alcoholic beverages (part of food processing, I-O 14), motor vehicles (I-O 59), amusements (I-O 76), rubber tires (part of rubber and miscellaneous plastics, I-O 32), and household appliances (I-O 54).⁵ The share is relatively high in finance and insurance (I-O 70) because of the stock transfer tax, and in trade (I-O 69) because of general sales taxes.

of the first type are petroleum refining (I-O 31), textile manufacturing (I-O 16, 17), and primary nonferrous metals (I-O 38). Manufacturers of farm machinery and equipment (I-O 44) and of motor vehicles and equipment (I-O 59) are examples of the latter type.

Primary inputs per dollar of industry's sale to final demand

Input-output analysis establishes the relationship between the value of products delivered to final demand (GNP) and the primary inputs required directly and indirectly in order to supply them. Primary inputs are those inputs that are not the output of other producing industries in the system; they consist of the components of value added and imported goods and services. This section shows the value-added and import content of \$1.00 of each industry's final product.

To deliver a unit of its product to final demand, each industry directly and indirectly consumes the output of the other producing industries in combination with its own primary inputs of value added and imports. The output provided by its supplying industries can in turn be disaggregated into the primary inputs of these industries and output supplied by their suppliers. This analysis can be continued in turn through the full chain of production so that each industry's output is fully decomposed into its own primary inputs and its consumption of the primary inputs of its direct and indirect suppliers. In this way the requirements for an industry to deliver a unit of its product to final demand no longer consists of the outputs of its direct and indirect suppliers but of the primary inputs that have been absorbed by itself and its suppliers.

One way to calculate these primary input requirements for an industry is to multiply the coefficients from its column

Value Added and Output

Value added related to industry's total output

Columns 10 through 13 of table 1 show the ratio of each industry's value added, and its components, to the industry's total output. The ratio of value added to output varies from a high of 85 percent in communications (I-O 66) to a low of 18 percent in miscellaneous textiles and floor covering (I-O 17).⁶

The higher an industry's ratio of value added to output, the less input of goods and services it requires from other industries, and the less impact a change

in demand for its output will have on other industries.

The industries with the highest ratios are mainly service-type industries—communications (I-O 66), real estate and and rentals (I-O 71), Federal Government enterprises (I-O 78), trade (I-O 69), etc.—or extractive industries—coal mining (I-O 7), crude petroleum and natural gas (I-O 8). Of the 23 industries in which value added is 50 percent or more of output, only 3 are manufacturing industries: optical, ophthalmic, and photographic equipment (I-O 63), glass and glass products (I-O 35), and office, computing and accounting machines (I-O 51). The industries with the lowest ratios of value added to output are mainly the highly mechanized manufacturing industries that process large volumes of raw materials without much labor, or that assemble highly fabricated and therefore costly components. Examples

5. Many of these taxes have been lifted or modified since 1963.

6. It should be noted that these ratios are affected by the conventions that have been adopted for constructing the national income and product accounts and the input-output accounts, such as: the inclusion of imputations for non-market transactions in the output of industries, the transfer treatment of secondary production and imports, the definition of output in wholesale and retail trade to reflect gross margins on the sale of merchandise, etc. These and other conventions which affect the ratios of value added to output are discussed in the technical note at the end of this article.

Footnotes for Table 1.

1. The dummy industries, business travel and entertainment (I-O 51), office supplies (I-O 82), and scrap, used, and secondhand goods (I-O 83) have no value added and are omitted from this list.

2. The ratios of value added and its components to total output in Federal Government enterprises (I-O 78) agree with the direct requirements coefficients published in the November 1968 Survey. They were modified to exclude the operations of the Commodity Credit Corporation. The nature of the Corporation's activities can vary significantly from year to year and, therefore, would introduce an element of instability into the coefficients. The components of value added relating to CCC operations which have been subtracted from the figures in columns 2, 4, and 5 for I-O 78 (and for the Government enterprise subtotal) before calculating

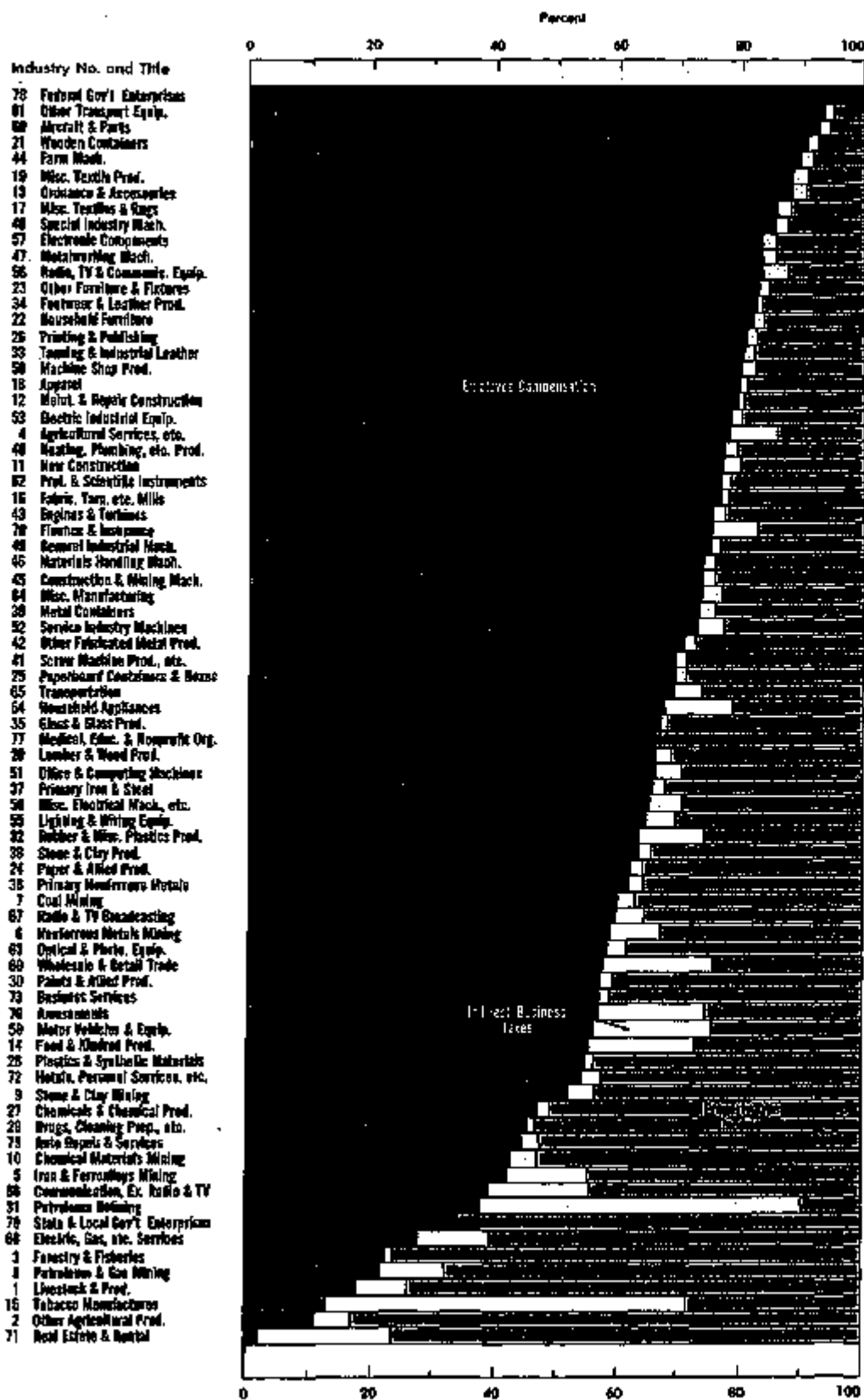
the ratios in columns 10, 12, and 13 are as follows (in \$billions): total value added, \$-1,531; indirect business taxes, \$89; profit-type income, \$-1,090.

3. Total output of the rest of the world industry (I-O 35) reflects U.S. earnings from foreign investments and a small amount of compensation paid by foreign organizations to U.S. citizens. Earnings by foreigners from their investments in the U.S. are treated in the I-O accounts as a transferred import. Thus, value added in the rest of the world industry reflects net factor income received in the U.S. Since receipts and payments on foreign investment accounts would be determined independently in other years, the 1963 ratio would have no applicability to other years.

Note.—Details may not add to totals because of rounding. Source: U.S. Department of Commerce, Bureau of Economic Analysis.

CHART 11

Composition of Value Added: Industries Ranked by the Share of Employee Compensation in Value Added



in the total requirements table in the input-output study (table 3 in the November 1969 article) by the ratio of value added to output for the corresponding producing industry shown in columns 10-13 of table 1 (with a ratio of 1.0 applied to imports). When the coefficients in any given column of the total requirements table are multiplied by the ratios of total value added to output for the appropriate producing industries, the derived ratios will represent the amounts of value added and imports required directly and indirectly to deliver \$1.00 of output to final demand (GNP). The derived ratios in each column will sum to 1.0; that is, \$1.00 of sales to final demand generates \$1.00 of value added.⁷ This demonstrates that the value of an industry's final output is the sum of the value added by that industry and the value that has been added by all the other industries (including imports) that supplied inputs directly and indirectly. If the total requirements coefficients for a given industry are multiplied by the ratios of the separate value-added components to output, one can calculate the amounts of the separate primary inputs (the three value-added components plus imports) that directly and indirectly make up \$1.00 of the given industry's final output. Table 2 shows the value-added and import content per dollar of each industry's final product in 1963.

It can be seen from table 2 that the composition of the primary inputs per dollar of final output varies widely among industries. For instance, \$1.00 spent on tobacco products (I-O 15) generates 21 cents of employee compensation, but if spent on aircraft and parts (I-O 60) it generates 78 cents of employee compensation. The amount of indirect business taxes per dollar of final output is a fairly uniform 4 to 5 cents except in industries such as tobacco (I-O 15) and petroleum (I-O 31) whose products are subject to special excise taxes. The amount of property-type income per dollar of final output ranges from 7 cents for Federal Government enterprises (I-O 78) to 66 cents

7. Because of the treatment of scrap and byproducts in the I-O system this statement requires a slight qualification, discussed in a technical note at the end of the article.

for agricultural crops (I-O 2) and the real estate and rental industry (I-O 71). The amount of imports per dollar of final output is generally less than 5 cents except in industries in which imports are a significant part of total supply, such as forestry and fishery products (I-O 3) and iron mining (I-O 5).

Value-Added and Import Content of GNP Components, 1963

THE estimated primary inputs per dollar of industry sales to final demand (table 2) were used to calculate the amount of employee compensation, indirect business taxes, property-type income, and imports generated in 1963 by each major GNP component: personal consumption expenditures, gross private domestic investment, gross exports, Federal Government purchases, State and local government purchases. Sales by each I-O industry to each of the major GNP components in 1963 are shown in table 1 of the November 1969 SURVEY article. These data on the industrial composition of the GNP components combined with the data presented here on primary inputs required per dollar of each industry's sales to final demand yield the estimates shown in table 3 of the amounts of employee compensation, indirect business taxes, property-type income, and imports generated by each GNP component.*

In calculating GNP, exports are entered net of imports. In input-output analysis, however, it is gross exports that are of interest when one wants to trace the direct and indirect impacts of final demand on the producing industries. In table 3 of this article, the export column of final demand reflects gross exports, and the accounts are balanced by showing gross imports as a

Table 2.—Primary Inputs Per Dollar of Industry's Sale to Final Demand

(Cents)						
Industry No.	Industry	Employee compensation	Indirect business taxes	Property-type income	Imports	Total
1	Livestock & livestock products.....	28.2	08.9	48.6	03.6	100.0
2	Other agricultural products.....	22.3	7.3	55.7	3.1	100.0
3	Forestry & fishery products.....	23.3	3.2	48.7	27.2	100.0
4	Agriculture, forestry & fishery services.....	48.8	7.0	39.9	2.9	100.0
5	Iron & ferroalloy ores mining.....	80.3	7.9	29.4	32.4	100.0
6	Nonferrous metal ores mining.....	45.0	7.0	28.6	18.4	100.0
7	Coal mining.....	57.2	4.7	39.8	1.3	100.0
8	Crude petroleum & natural gas.....	23.8	10.5	59.2	9.4	100.0
9	Stones & clay mining & quarrying.....	40.2	4.7	38.1	7.0	100.0
10	Chemical & fertilizer mineral mining.....	39.8	4.8	40.8	14.6	100.0
11	New construction.....	64.3	4.4	27.2	3.1	100.0
12	Maintenance & repair construction.....	67.9	4.4	25.4	2.2	100.0
13	Ordinance & accessories.....	78.5	3.7	17.1	2.7	100.0
14	Food & kindred products.....	43.0	10.3	39.8	4.4	100.0
15	Tobacco manufactures.....	31.1	40.1	36.3	2.8	100.0
16	Broad & narrow fabrics, yarn & thread mills.....	54.3	4.6	33.4	7.7	100.0
17	Miscellaneous textile goods & floor coverings.....	50.6	4.8	26.8	17.8	100.0
18	Apparel.....	65.1	4.0	26.9	4.0	100.0
19	Miscellaneous fabricated textile products.....	62.7	5.0	26.2	6.1	100.0
20	Lumber & wood products, except containers.....	51.1	4.0	31.4	13.5	100.0
21	Wooden containers.....	45.4	4.1	22.8	7.6	100.0
22	Household furniture.....	64.9	4.5	28.0	4.6	100.0
23	Other furniture & fixtures.....	67.1	4.3	24.8	3.8	100.0
24	Paper & allied products, except containers.....	40.8	4.1	32.1	13.0	100.0
25	Paperboard containers & boxes.....	38.6	4.0	31.3	6.2	100.0
26	Printing & publishing.....	65.8	4.4	26.6	3.3	100.0
27	Chemicals & selected chemical products.....	45.8	5.3	42.8	6.1	100.0
28	Plastics & synthetic materials.....	40.1	4.5	41.1	4.3	100.0
29	Drugs, cleaning & toilet preparations.....	49.1	4.4	43.4	3.1	100.0
30	Paints & allied products.....	54.8	4.6	38.8	3.8	100.0
31	Petroleum refining & related industries.....	32.8	20.2	38.2	9.1	100.0
32	Rubber & miscellaneous plastics products.....	55.4	3.0	32.3	6.3	100.0
33	Leather tanning & industrial leather products.....	32.6	6.5	31.0	9.9	100.0
34	Footwear & other leather products.....	67.8	4.1	22.5	4.6	100.0
35	Glass & glass products.....	59.6	3.6	32.9	4.1	100.0
36	Stones & clay products.....	57.0	4.4	34.7	3.9	100.0
37	Primary iron & steel manufacturing.....	57.0	4.2	31.2	7.4	100.0
38	Primary nonferrous metals manufacturing.....	49.7	4.4	30.9	15.2	100.0
39	Metal containers.....	62.0	4.4	29.2	4.4	100.0
40	Heating, plumbing & structural metal products.....	64.8	4.3	27.3	4.1	100.0
41	Stampings, screw machine products & bolts.....	61.4	4.0	30.1	4.5	100.0
42	Other fabricated metal products.....	60.9	4.1	29.3	6.8	100.0
43	Engines & turbines.....	66.6	4.0	28.8	4.1	100.0
44	Farm machinery & equipment.....	67.8	4.8	20.6	7.4	100.0
45	Construction, mining & oil field machinery.....	65.1	4.3	27.1	2.6	100.0
46	Materials handling machinery & equipment.....	44.9	4.4	27.2	3.6	100.0
47	Metal working machinery & equipment.....	70.8	4.9	21.6	4.0	100.0
48	Special industry machinery & equipment.....	68.1	4.4	21.8	6.7	100.0
49	General industrial machinery & equipment.....	66.0	4.0	28.4	3.6	100.0
50	Machine shop products.....	69.9	4.2	22.4	2.5	100.0
51	Office, computing & accounting machines.....	61.8	5.0	29.1	4.1	100.0
52	Service industry machines.....	64.5	5.6	29.4	2.5	100.0
53	Electric industrial equipment & apparatus.....	67.4	2.0	24.0	3.9	100.0
54	Household appliances.....	61.7	7.5	27.3	2.5	100.0
55	Electric lighting & wiring equipment.....	60.0	5.6	30.5	5.0	100.0
56	Radio, television & communication equipment.....	71.8	4.1	19.2	4.0	100.0
57	Electronic components & accessories.....	69.8	4.3	22.1	2.8	100.0
58	Misc. electrical machinery, equipment & supplies.....	69.2	5.0	28.3	5.6	100.0
59	Motor vehicles & equipment.....	57.1	11.9	27.7	3.4	100.0
60	Aircraft & parts.....	77.8	3.6	15.7	2.9	100.0
61	Other transportation equipment.....	71.4	4.2	19.5	4.9	100.0
62	Scientific & controlling instruments.....	68.6	4.1	25.0	2.5	100.0
63	Optical, photographic & photographic equipment.....	54.3	4.3	34.4	6.6	100.0
64	Miscellaneous manufacturing.....	55.8	6.0	28.6	9.6	100.0
65	Transportation & warehousing.....	59.6	6.1	28.4	5.9	100.0
66	Communications; ex. radio & TV broadcasting.....	40.9	16.4	45.1	7.7	100.0
67	Radio & TV broadcasting.....	54.7	2.7	25.4	1.2	100.0
68	Electric, gas, water & sanitary services.....	33.6	8.1	32.4	2.0	100.0
69	Wholesale & retail trade.....	64.4	16.1	28.7	8.8	100.0
70	Finance & insurance.....	66.9	8.2	24.6	1.4	100.0
71	Real estate & rental.....	16.4	17.0	66.1	6.6	100.0
72	Hotels; personal & repair services, ex. auto.....	62.6	5.4	46.9	1.2	100.0
73	Business services.....	58.7	4.5	37.3	1.5	100.0
74	Automobile repair & service.....	47.0	5.4	44.6	1.1	100.0
75	Amusements.....	50.4	14.9	31.6	3.0	100.0
76	Medical, educational, ex. & nonprofit org.....	50.2	3.6	36.4	7.7	100.0
77	Federal government enterprises.....	58.7	1.8	7.4	5.1	100.0
78	State & local government enterprises.....	42.7	2.7	53.0	1.1	100.0
79	Imports.....				100.0	100.0
80	Business travel, entertainment, & gifts.....	58.4	8.5	33.1	7.0	100.0
81	Office supplies.....	81.0	4.5	28.2	5.9	100.0
82	Government industry.....	100.0				100.0
83	Rest of the world industry.....	1.0		99.0		100.0
84	Household industry.....	200.0				100.0
85	Inventory valuation adjustment.....			100.0		100.0

Sources: U.S. Department of Commerce, Bureau of Economic Analysis.

3. The value-added content of GNP components can also be calculated using the total requirements table (table 3 in the 1966 article) to generate the total output required directly and indirectly from each industry and then applying the ratios of value added to output from table 1 of this article to derive the primary inputs. This calculation will also yield the industrial composition of the value-added components which cannot be obtained from the information in table 2. BEA has developed a set of four special value-added coefficient matrices, one for total value added and each of its components, that permit the calculation to be made in one step. They are described in the technical note at the end of the article and their use is illustrated in the following section.

Table 3.—Value-Added and Import Content
of Major Components of GNP, 1963

	Total	Personal consumption expenditures	Gross private domestic investment	Gross exports	Federal Government purchases	State and local government purchases
(Millions of dollars)						
Primary inputs:						
Employee compensation.....	341,314	175,295	53,614	14,588	50,176	47,839
Indirect business taxes.....	54,837	42,786	5,648	2,272	2,179	1,732
Property-type income.....	104,248	140,572	28,238	14,187	7,719	8,825
Value added (GNP).....	500,399	358,653	87,497	31,047	60,074	62,116
Imports.....	26,638	18,817	3,332	1,423	4,039	967
Value added & imports.....	527,037	377,470	90,829	32,470	64,113	63,083
Distribution of Primary Inputs Among Final Demand Components (Percent)						
Employee compensation.....	100.0	51.3	15.7	4.3	14.7	14.0
Indirect business taxes.....	100.0	78.2	10.3	4.2	4.0	3.2
Property-type income.....	100.0	72.4	11.9	7.5	4.0	4.4
Value added (GNP).....	100.0	60.7	14.9	5.3	18.2	9.8
Imports.....	100.0	62.4	12.6	6.3	15.2	3.6
Value added & imports.....	100.0	60.5	12.9	5.2	18.4	9.6
Composition of Final Demand Components by Type of Primary Input (Percent)						
Employee compensation.....	55.3	46.7	62.1	44.9	78.3	31.0
Indirect business taxes.....	8.9	11.4	6.4	7.0	3.4	2.9
Property-type income.....	31.5	37.4	27.1	48.7	12.0	14.4
Value added (GNP).....	55.7	36.6	96.1	96.6	93.7	58.4
Imports.....	4.3	4.5	3.9	4.4	6.3	1.6
Value added & imports.....	100.0	100.0	100.0	100.0	100.0	100.0

Source: U.S. Department of Commerce, Bureau of Economic Analysis.

Table 4.—Employee Compensation Generated
by Alternative Expenditures of \$1 Billion

Personal Consumption Expenditures			Gross Private Domestic Investment		
Industry	Million \$	Percent of total	Industry	Million \$	Percent of total
Total.....	463.4	100.0	Total.....	634.9	100.0
69 Wholesale and retail trade.....	113.3	24.4	11 New construction.....	173.7	27.4
77 Medical, edu., & nonprofit org.....	37.6	8.0	69 Wholesale & retail trade.....	64.1	10.1
78 Finance & insurance.....	32.5	6.9	37 Primary iron & steel.....	31.6	5.0
14 Food & kindred products.....	27.1	5.8	25 Transportation.....	27.8	4.3
65 Transportation.....	25.6	5.4	48 Heating, plumbing, etc. prod.....	19.4	3.1
73 Business services.....	16.8	3.6	28 Stone & clay products.....	19.8	3.0
12 Maint. & repair construction.....	14.1	3.0	59 Motor vehicles & equip.....	19.2	3.0
18 Apparel.....	13.8	2.9	73 Business services.....	17.0	2.7
72 Hotels, personal serv., etc.....	13.0	2.8	53 Electric industrial equip.....	14.6	2.3
26 Printing & publishing.....	11.9	2.6	37 Metalworking mach.....	13.5	2.1
All other.....	186.2	36.4	All other.....	234.2	36.9
Public Education			Construction of Multifamily Dwellings		
Industry	Million \$	Percent of total	Industry	Million \$	Percent of total
Total.....	651.9	100.0	Total.....	538.6	100.0
84 General government.....	589.3	77.8	11 New construction.....	299.9	47.0
11 New construction.....	42.0	4.9	69 Wholesale & retail trade.....	54.4	8.5
69 Wholesale & retail trade.....	19.3	2.2	28 Stone & clay products.....	34.5	5.4
65 Transportation.....	13.9	1.6	48 Heating, plumbing, etc. prod.....	29.0	4.6
26 Printing & publishing.....	11.2	1.3	25 Transportation.....	27.7	4.3
73 Business services.....	7.7	.9	37 Primary iron & steel.....	21.2	3.3
37 Primary iron & steel.....	5.5	.6	73 Business services.....	20.5	3.3
36 Stone & clay products.....	5.0	.6	20 Lumber & wood products.....	20.1	3.2
14 Food & kindred products.....	4.7	.6	42 Other fabricated metal prod.....	8.3	1.3
68 Electric, gas, etc. serv.....	4.7	.6	70 Finance & insurance.....	8.2	1.3
All other.....	77.8	9.1	All other.....	113.9	17.9

Source: U.S. Department of Commerce, Bureau of Economic Analysis.

primary input. In this way it is possible to show the direct and indirect import content of the various categories of final demand.

The top panel of table 3 shows the dollar amounts of the primary inputs generated by each major component of final demand. For instance, personal consumption expenditures (PCE) generated \$175 billion of employee compensation in 1963, \$43 billion of indirect business taxes, \$141 billion of profit-type income, and \$17 billion of imports.

The second panel of table 3 shows the distribution of each primary input among the components of final demand. Personal consumption expenditures are the largest final demand component, accounting for 60.9 percent of gross final demand. However, the shares of the primary inputs generated by personal consumption expenditures range as low as 51.3 percent for employee compensation and as high as 78.3 percent for indirect business taxes.

Conversely, the impact of gross private domestic investment is heaviest on employee compensation and least on indirect business taxes: gross private domestic investment accounts for 13.9 percent of gross final demand but it generates 15.7 percent of total employee compensation and only 10.3 percent of total indirect business taxes.

The third panel of table 3 shows the composition of each component of final demand in terms of primary inputs. Differences in these patterns of primary inputs result from the differing industrial composition of the expenditures for final products that make up the components. The composition of total final demand in 1963 was 55 percent employee compensation, 9 percent indirect business taxes, 32 percent property-type income, and 4 percent imports. The composition of PCE in terms of primary inputs was markedly different, with employee compensation accounting for 47 percent and property-type income for 37 percent. This difference is related to the fact that large amounts of consumer expenditures are for output of the food (I-O 14), trade (I-O 69), and real estate and rental (I-O 71) industries, whose value-added content (as shown in table 2) is characterized by relatively

small amounts of employee compensation and large amounts of property-type income; and to the fact that many sales and excise taxes are aimed at products and services consumed by persons.

The rather large share (62.5 percent) of employee compensation in the primary inputs generated by gross private domestic investment reflects the fact that the new construction industry (I-O 11), whose value added content consists heavily of employee compensation, makes up over 50 percent of this final demand category.

Income from foreign investments (I-O 85), and from the sales of agricultural crops (I-O 2), food and kindred products (I-O 14), and chemicals (I-O 27) were important export receipts in 1963. These industries all have higher-than-average shares of property-type income in their value added; therefore, property-type income has an above average share

(44 percent) in the primary input content of exports.

Compensation of Government employees is a significant part of the purchases of both Federal and State-local governments, and thus is the dominant element in the primary inputs generated by government purchases.

Imports constitute 4.3 percent of primary inputs to final demand as a whole, and there is a similar import share in the primary inputs generated by personal consumption expenditures, private investment, and exports. Imports are a very small share (1.6 percent) of the primary inputs generated by State-local government purchases, but are 6.3 percent of the primary inputs generated by Federal Government purchases. Expenditures to maintain establishments overseas were largely responsible.

Only three commodity-producing industries appear among the 10 most affected by the "PCE" alternative: food and kindred products (I-O 14), apparel (I-O 18), and printing and publishing (I-O 26), and they account for only 11 percent of the total compensation generated. Although five commodity-producing industries appear on the list for the "education" alternative they account for only 8 percent of the total compensation generated.

The impact of the other two alternatives, "investment" and "multifamily dwellings," is mainly on the commodity-producing industries. New construction (I-O 11) is the most important in both. The other commodity-producing industries affected by the "multifamily dwellings" alternative are those directly and indirectly supplying the construction industry, e.g., stone and clay products (I-O 36), primary iron and steel products (I-O 37), lumber and wood products (I-O 20). Equipment-producing industries affected by the "investment" alternative are: motor vehicles (I-O 59), electric industrial equipment (I-O 53), and metal working machinery and equipment (I-O 47).

Three service-type industries appear rather prominently on all four lists: trade (I-O 69), transportation (I-O 65), and business services (I-O 73). The trade and transportation industries are associated with virtually all transactions involving the sale and movement of materials from producer to both intermediate and final consumers. Business services, which include advertising, are also important inputs to most producing industries. Therefore, these rather universally used services become widely diffused indirectly as well as directly as inputs associated with any pattern of final expenditures.

Table 4 indicates the industrial concentration of the employee compensation generated by the alternative expenditure patterns. Almost one-fourth of the effect of the "PCE" alternative is in trade (I-O 69), and 65 percent of the total effect occurs in the 10 top industries listed in table 4. The remaining 35 percent is spread among all other industries. The concentration for the "investment" alternative is similar,

Industrial Composition of Employee Compensation Generated by Alternative Patterns of Final Demand

THIS section illustrates the use of input-output analysis and the value-added data presented in this article to examine the amount and the industrial distribution of employee compensation generated by different types of final expenditures. The technique can, of course, be used to examine impacts on the other components of value added as well.

The illustration considers four different \$1 billion increments to final demand, each of which could result fairly directly from policy decisions. The first alternative is \$1 billion of PCE—i.e., \$1 billion whose industrial composition is the same as that of PCE.⁹ This might be thought of as, e.g., a change in spending resulting from changes in personal income taxes. The second alternative uses the industrial composition of gross private domestic investment, and could represent a change in spending resulting from a change in the investment tax credit.

The industrial composition of government purchases of goods and services for public education is used for the third alternative, and the fourth uses the composition of inputs required for the construction of multifamily housing.

Each expenditure alternative was applied to a special matrix of coefficients that measures for each industry the total employee compensation generated directly and indirectly in its supplying industries per dollar of the industry's output delivered to final demand.¹⁰ The results are summarized in table 4, which shows the I-O industries most affected by each alternative. The total amount of compensation generated by \$1 billion of final demand varies from a low of \$469 million for the "PCE" alternative to a high of \$861 million for the "education" alternative.

The compensation generated by the "PCE" and "education" alternatives is mainly in the non-material producing

9. The four patterns of expenditures are meant to be illustrative. The average pattern in 1963 is used for each, although it is recognized that the industrial composition of incremental changes in a particular type of expenditure may differ from that of the category as a whole.

10. This is one of the four special coefficient matrices developed by BEA that are described in the technical note at the end of the article.

with 27 percent of the employee compensation occurring in the construction industry (I-O 11) and 63 percent of the total occurring in the leading 10 industries. In the "education" alternative, however, direct payments of wages and salaries by school systems account for

78 percent of the total impact and the 10 listed industries account for over 90 percent of the total. In the "multifamily dwellings" alternative, almost one-half of the impact is in the construction industry itself and the 10 top industries account for over 80 percent of the total.

Use in Price Analysis

INPUT-OUTPUT analysis has been used to assess the potential impact of changes in the price of primary factors of production on the prices of other goods and services. For example, if changes in wage rates change the unit cost of labor in an industry, what is the likely effect on prices in the rest of the economy? Input-output analysis can trace the impacts on the prices of other goods and services if it is assumed that the increased factor cost is reflected in the price of the product of the industry where it occurs and that the increased cost to other users of the product is passed on exactly in the prices of their products. A simple example will illustrate how the effects of such a pass-through of increased factor cost would be calculated.

Assuming a 10 percent increase in unit labor costs in the iron and steel industry (I-O 37), what will be the impact on the price of motor vehicles (I-O 59)? If the iron and steel industry passes on 100 percent of the increased cost, the rise in price of iron and steel to its users would be 10 percent of .278, the ratio of compensation to output for the iron and steel industry as shown in column 4 of table 1. The amount of iron and steel that the motor vehicle industry requires directly and indirectly per dollar of its finished product is \$0.21208 (the coefficient from row 37, column 59 of table 3, the total requirements table, in the November 1969 SURVEY article). The calculation ($.10 \times .278 \times \$0.21208$) equals \$0.006 per \$1.00 of output, or an indicated rise of .6 percent in the factory price of motor vehicles.¹¹

Similar calculations will show the

effects of the rise in iron and steel wage costs on the price of finished products of other industries, and the effects of changes in the cost of other components of value added. If changes also occur in the costs of primary inputs to other industries the resulting calculations can be accumulated to determine the total effect on the price of any product.

Although more elaborate price models

in which pass-through assumptions can be modified are possible, the I-O approach to price analysis is essentially static. The assumptions underlying it are rigid and not always realistic in situations where dynamic factors are likely to be dominant—as is usually the case when there are real pressures on prices. The analysis does not allow for the effects of relative price changes on the quantity of goods purchased by producing industries (substitution) nor does it permit evaluating the "bandwagon" effect whereby a price increase in one industry stimulates price increases in other industries which are unrelated to cost considerations. However, the I-O approach does isolate one element in the complex set of factors which influence prices and may be useful in situations when the assumptions appear reasonable; e.g., a period of cost-push inflation.

Appendix: Reconciliation of Alternative Estimates of Industry Value Added:

1963 Gross Product Originating and Value Added

In the 1963 I-O Study

BEA prepares annual estimates of gross product originating (GPO) in each major industry. (Preliminary estimates for 1972 are on page 19 of this issue; revised estimates are published each July.) The estimates of value added for industries in the 1963 input-output study are based mainly on the GPO estimates for that year and conceptually agree in total. However, the data underlying the GPO estimates have been reallocated to match the industrial classification and the concepts and conventions used in the I-O study. In addition, some preliminary revisions to the GPO estimates, made in connection with work on the 1963 benchmark of the national accounts, have been incorporated into the I-O estimates of industry value added but not yet into

the GPO data. Table 5 reconciles the two sets of industry value-added estimates showing the amounts and main reasons for the differences at the industry detail for which the GPO estimates are published. This reconciliation should be helpful to anyone wishing to adapt the more current GPO data in modifying or updating the 1963 table for use in input-output applications.

The differences shown in column 2 of table 5 are due to differences in the industry classifications used in compiling the two sets of data. The GPO estimates adhere strictly to the Standard Industrial Classification (SIC). In the I-O system, however, some industries are reclassified in order to achieve industry groups that are more homogeneous and that thus have a more

11. The calculations can be made more directly with the special value-added coefficient matrices described in the technical note.

stable input structure. These reclassifications, identified in table 5 by SIC code, consist of shifting veterinary services from the agricultural sector to the services sector, oil and gas field drilling services from mining to construction, and trading stamp companies from services to wholesale and retail trade.

Columns 3 and 4 of table 5 give the differences between the GPO and the I-O value-added estimates that are due to the "redefinition" of certain activities (rather than whole SIC industries) from one industry to another. Column 5 shows the differences that are due to the fact that in the I-O system all construction and installation work performed by employees in establishments not in the construction industry (i.e., force account construction) is redefined to be in the construction industry. Column 6 shows the effects of all other redefinitions: manufacturing and service activities that occur in the trade and transportation industries are shifted to the appropriate manufacturing and service industries; trade activities occurring in other industries are shifted

to wholesale and retail trade; and manufacturers' sales offices are shifted from wholesale trade to manufacturing. The details underlying the figures in column 4 are given in footnotes to the table.

In the calculation of the GPO estimates, the inventory valuation adjustment is distributed among the industries holding inventories. In the input-output table it appears as a separate industry (I-O 87). The resulting differences in value added by industrial sector are given in column 5.¹²

The remaining differences, shown in column 6, are essentially statistical. There are three main sources of these differences.

First, preliminary 1963 benchmark revisions to the national income and product (NIP) accounts have been incorporated into the I-O value added figures estimates but not into the GPO estimates. These preliminary revisions lowered total GNP slightly (\$114 mil-

lion) and changed the allocation among industries.

Second, the statistical discrepancy in the NIP accounts—the difference between the "income side" and the "product side" estimates of national output—is shown as a separate total in the GPO estimates. In the I-O tables, however, there is no statistical discrepancy, since the sum of value added by industry equals GNP.

Third, some estimates of value added for the input-output table are derived from different sources from those used in estimating GPO. For example, the 1963 I-O estimates of employee compensation in the detailed mining and manufacturing industries were based on data from the 1963 Censuses of Manufactures and Mineral Industries, whereas State unemployment insurance records were used for the GPO estimates. Also, estimates of property-type income for some of the I-O industries were derived from the reports of regulatory agencies, whereas Internal Revenue Service data were used in estimating GPO.

12. The industrial distribution of IVA varies greatly from year to year. Therefore the pattern shown in column 5 should not be used as a model. Annual data on IVA in this detail are published in table 6.10 of the national income and product accounts.

Table 5.—Reconciliation of Estimates of Industry Value Added, 1963

(Millions of dollars)

Industry	SIC classification		Published gross product originating	Rede- finitions	Redefinition		Statistical		Input-output value added
	Gross product originating	Input-output			Force account construction	Other	Inventory valuation adjustment	Other	
			1	2	3	4	5	6	7
Agriculture, forestry, fisheries	01-09	01-09 (ex. 0722)	22,071	-240				-23	22,702
Farms	01-02	01-02	(21,845)					(-23)	(21,822)
Mining	10-14	10-14 (ex. 138)	12,121	-898	-554		-5	-616	11,049
Contract construction	15-17	15-17, 138, pt. 8583	26,880	+932	+8,856	+1,857	-1	+222	37,032
Manufacturing	19-89	19-89	167,032	-597		+3,948	+304	+87	170,873
Transportation	40-47	40-47	23,136		-767	+1,88	+4	-585	23,873
Communications	48	48	12,876		-433			+280	12,723
Communication, ex. radio & TV	481, 2, 9	481, 2, 9	(11,635)		(-433)			(+380)	(11,433)
Electric, gas, water, sanitation	49	49	14,892		-1,022		-1	+5	13,874
Wholesale and retail trade	50-59	50-59, 7095	97,191	+62	-189	+1,121	+1	-536	98,448
Finance, insurance, real estate	60-67	60-67 (ex. pt. 6561)	80,909		-1,161	+1,146		+243	80,137
Finance and insurance	60-64	60-64	(18,790)		(-23)			(-219)	(18,548)
Services	70-83	70-83 (ex. 7095, 0722)	60,927	+184	-216	+1,287		+689	64,783
Government & government enterprises	91-93	91-93	65,997		-2,886			-73	62,038
General government	pt. 91-93	pt. 91-93	(58,120)		(-2,884)			(-157)	(55,029)
Rest of the world	n.a.	n.a.	3,364					-105	3,259
Inventory valuation adjustment	n.a.	n.a.	0				-303		-303
Statistical discrepancy			-204					+294	0
All industries (GNP)			\$90,583	0	0	0	0	-114	\$90,369

n.a. Not applicable.

1 Net figure made up of \$-118 for merchandise sales by construction contractors, \$-150 for service receipts from rental of construction equipment, and \$-426 from construction activity of operative builders in the real estate sector.

2 Includes: \$-1,071 from manufacturing activities and \$-1,280 from manufacturers' sales offices in trade, and \$-62 from manufacturing activity in car shop of railroads.

3 Net figure: \$-13 for merchandise sales in transportation, \$-62 for manufacturing activity in railroad car shops, and \$-153 from storage receipts in the trade sector.

4 Net figure: \$-3,891 for manufacturing activity in trade, \$-5,910 for service receipts in trade, \$-189 for storage receipts in trade, and \$-1,833 from trade receipts in other sectors.

5 Net figure: \$+1,071 from imputed rents in nonprofit institutions, and \$-425 for construction receipts of operative builders.

6 Net figure: \$+6,080 from service receipts in other sectors, \$-1,702 for merchandise sales in service establishments, and \$-1,071 for imputed rents in nonprofit institutions.

NOTE.—Details may not add to total because of rounding.
Source: U.S. Department of Commerce, Bureau of Economic Analysis.

Technical Note

A. The methods used to allocate value added and its components in mining and manufacturing may have resulted in errors that have a cumulative effect on property-type income of the industries in these sectors. Value added for industries in mining and manufacturing was calculated by subtracting estimates of purchased business services (developed in the I-O analysis of intermediate inputs) from Bureau of the Census data on "value added by manufacturers." These industry estimates were adjusted to the control total for value added in the major industry divisions and then adjusted to reflect the reclassifications and redefinitions used in the I-O study. The next step involved the allocation of employee compensation and indirect business taxes among the mining and manufacturing industries. Employee compensation estimates were based on Census data on establishment payrolls, adjusted to include wage supplements and to reflect redefinitions and reclassifications. The allocation of indirect business taxes to mining and manufacturing industries was based on several sets of allocators, depending on the type of tax or nontax payment, and also adjusted for redefinitions and reclassifications. Property-type income for an industry was estimated as a residual and was, therefore, subject to errors in estimating total value added or either of the other components.

B. The ratios of value added to total output (columns 10 through 13 of table 1) are intended for use with the published input-output tables and the reader is cautioned against applying them to other sets of data relating to production or output without taking account of the special conventions used in the I-O table which affect the ratios. The main conventions and definitions affecting the I-O data on output and value added are as follows:

(1) Imputations have been included in the I-O measures of output which are not reflected in the ordinary statistics on output in dollar terms. The main imputations occur in agriculture, for the value of nonpurchased feed, seed, and fertilizer; in finance and insurance, for the imputed value of banking services; and in the rental and real estate industry, for the imputed rental value of owner-occupied houses.

(2) In most cases secondary production has been treated in the I-O system as if it were sold by the industry where it was made to the industry producing it as its primary activity. This is done

in order to supply a product to all users from a single source. Consequently, the output of such "transferred" secondary products is counted twice—once in the industry where it is made and again in the industry from which it is distributed.

(3) In other cases secondary activities have been "redefined" from the industry where they occur to the industry where they are primary. This means that both the output and corresponding inputs (intermediate and value added) have been shifted. If these redefinitions are sizeable, they can affect the value-added ratios of the industries involved. In the case of force account maintenance and repair construction, the value added and intermediate inputs which have been redefined out of an industry are replaced by an intermediate purchase of repair and maintenance services, thus reducing the ratio of value added to output.

(4) Imports of goods and services which are the same as those produced domestically and which are used in further production (transferred imports) are added to the total output of the industry producing the domestic counterpart. If such imports are a significant part of the total supply they affect the value-added ratio.

(5) The output of wholesale and retail trade is defined as gross margins and excludes the value of goods purchased for resale.

(6) Excise taxes are added to Census value of shipments and to value added. Similarly, general and special sales taxes are added to the output and value added of the industries which collect and remit them. Customs duties are part of the output and value added of wholesale trade.

C. In describing the derivation of table 2, "Primary Inputs Per Dollar of Industry Sales to Final Demand," the column of coefficients from the total requirements table (table 3 in the November 1969 article) was described as a set of weights which when applied to the appropriate value-added-to-output ratios will make the column sum to 1.0. However, because of the treatment of scrap and byproducts in the input-output tables, this is not true in all cases. In analyzing the demand for industry output, it is desirable to avoid the anomalous situation in which the demand for scrap and byproducts would generate output in the industry which yields them. Therefore, the direct requirements coefficients (table 2 in the November 1969 article) were adjusted to interrupt the flow

of these products before the calculation of the total requirements table (table 3 in the 1969 article). The net effect of these scrap and byproduct adjustments on the direct requirements coefficients, which were then used to derive the total requirements table, results in a residual value-added coefficient which is slightly different from the one which is published. Consequently, the value-added calculations using the published total requirements coefficients and the published value-added coefficients will not sum to precisely 1.0 in all cases. Adjustments have been made in the weights used to combine the value-added-to-output ratios in order to eliminate the effects of this treatment of scrap and byproducts in the industries where it has a significant impact so that the value added and import content of each final product would add to 1.0.

D. BEA has created four sets of special value-added coefficients that can be used to calculate in one step the industry distribution of the value added generated directly and indirectly by an industry's sale to final demand. The four sets are:

Total value added
Employee compensation
Indirect business taxes
Property-type income

The set of special value-added coefficients was calculated by multiplying the rows of the total requirements table (table 3 in the 1969 article) by the ratio of value added to total output for the appropriate producing industries. To derive the set of special coefficients for each of the components of value added, the process was repeated, using the ratio to total output for the appropriate value-added component.

The four sets of special value-added coefficients are available on one magnetic tape and can be ordered for \$200. Request should be addressed to the Interindustry Economics Division, Bureau of Economic Analysis, U.S. Department of Commerce, Washington, D.C. 20230. A check payable to "SESA, Department of Commerce" for the total amount must be enclosed with the order. The tapes are generated on a Honeywell 1260. The data are inscribed as 7 track, 556 BPI, and are available in either even or odd parity. A detailed description of the tape layout is included with each data tape. Please specify parity desired when ordering tape.